

# TYPES OF DIGITAL LEARNING SOLUTIONS MOST USED BY EDUCATORS IN LATVIA

Katrina Elizabete Purina-Bieza<sup>1</sup>, Edīte Sarva<sup>2</sup>

<sup>1</sup> Rīga Stradiņš University, Latvia

<sup>2</sup> University of Latvia, Latvia

## ABSTRACT

Ongoing educational digitalization, as well as remote learning caused by the COVID-19 pandemic, has significantly promoted the use of digital technologies in education. Consequently, questions regarding the use of different digital solutions (DSs) have arisen, such as which DSs are best suited for teaching and learning, what types of digital learning solutions (DLSs) are freely accessible and what kinds of solutions are still insufficiently available to educators. The research questions were designed to answer (1) what kind of DSs educators are most interested in and (2) which DSs they have successfully implemented in their practice. To determine the answers to these questions, two separate data sets were combined. The first data set emerged from analysing site traffic data from the educational platform DigiKlase.lv, where DSs and educational resources that can be implemented in the teaching-learning process have been collected. The second data set was gathered during an educational technology mentor professional development course and from the Erasmus+ project "Network of technology INTEGRAtionists in pupils' informal education" (INTEGRA) educators in Latvia, where 798 educators were surveyed about their success with implementing DSs in their educational practice.

The results demonstrate that educators are most interested in electronic and digital teaching resources that are types of digital solutions with limited interactivity. Furthermore, educators are interested to further explore DLS that are accessible without registration, are free of charge, and contain methodological recommendations for using them in an educational setting. Nevertheless, instructions on how to use a DLS have a negative impact on their opening rate. Educators also prefer resources that are in the national language, visibly dismissing and not further exploring solutions that are in other widely used languages in Latvia, for example Russian or English. The data reveal that DSs are, overall, significantly less used in preschool settings and in subject areas that are not directly related to the usage of technology including solutions that could be used in any subject area like digital educational games, co-working documents etc. Furthermore, educators report that they have more successfully implemented DSs that emulate the analogue learning process, and fewer choose solutions that are related to working in a digital environment.

**Keywords:** *digital learning solutions, digital solutions, digital teaching materials, educator preferences, post-COVID education*

## Introduction

Studies show that educators are confused about the appropriate use of digital technologies in teaching (Becta, 2008; Darling-Hammond & Hyler, 2020; Instefjord & Munthe, 2017; McGarr & Gavaldon, 2020; Røkenes & Krumsvik, 2014; Tondeur et al., 2017; Yang & Huang, 2008). There are two widely discussed reasons for the challenges educators experience when implementing digital educational resources. First, the implementation of digital solutions (DSs) in teaching-learning practice is very different from their application in other professions (Krumsvik, 2014). For educators, the employment of DSs does not only mean the use of digital technologies for their personal and work purposes, but also includes the didactics as well as the presentation and explanation of digital technologies to students and the assessment of their usage (Lund & Erikson, 2016). Therefore, educators need in-depth digital skills to be able to ensure technology-enhanced learning (Gudmundsdottir & Hatlevik, 2018; Ottestad et al., 2014; Purina-Bieza, 2021). Second, due to rapid technological development, the education sector is not only undergoing active change and facing the need to adapt, but also encountering inevitable resistance and differences in opinions about the solutions implemented in teaching and learning (Macgilchrist et al., 2020; McGarr & Gavaldon, 2020). Furthermore, the quality, usefulness and availability of different DLSs (digital learning solutions) in education may vary greatly (Daniela et al., 2018; Daniela et al., 2021).

Nevertheless, the COVID-19 pandemic has greatly increased the usage of digital technology in education, as well as highlighting related challenges such as difficulties in communicating learning objectives and the remote teaching-learning process, recognizing false news and searching and selecting information for both students and educators, in addition to the lack of support when new DSs need to be implemented (Organisation for Economic Co-operation and Development [OECD], 2020; Rubene et al., 2021a). The data for this study were collected during the pandemic period and therefore represent educator practice during both remote and face-to-face teaching-learning processes.

The aim of this study is to explore what kind of DSs educators are most interested in and which digital solutions they have successfully implemented in their practice. These insights may help to design necessary interventions as well as plan the development of DLSs and assess their quality based on educator interests and needs.

The research questions are as follows:

1. What kind of DSs are educators most interested in?
2. Which DSs have educators successfully implemented in their practice?

### **Factors influencing the educator decision when choosing DLSS**

Several researchers have addressed the issue of successful DLSS in terms of what factors distinguish proficient educators from failing to implement DSs in education (see Table 1). Many of these researchers base their studies on the technology acceptance model created by Davis (1986), which illustrates user motivation for exploring digital technologies. It consists of interconnected motivational aspects: the perceived usefulness of the DS and ease of use that in combination emerges in the attitude towards usage of the DS and finally results in actual DS application (Davis, 1986). Based on this model, Panigrahi et al. (2018) suggest dividing factors that influence the use of DLSS into two categories: (1) personal factors, including attitude, perceived usefulness, ease of use, enjoyment, etc., and (2) environmental factors, including the characteristics of a solution, as well as aspects of subjective norms and national specificities. Analyses reveal that the most important factor for educators in choosing specific DSs is their attitude, which is closely related to their positive outcome expectations, self-efficacy, previous use of DSs and their colleagues' usage of DSs, as well as their perceived knowledge and skills in using them (Krejins et al., 2013; Van Acker et al., 2013). Furthermore, the educator's attitude and the usefulness of DSs are essential for the initial adoption of the solution. The experience and satisfaction with the solution lead to continued intentional usage (Panigrahi et al., 2018). Štemberger and Čotar Konrad (2021) note that student and educator attitudes towards digital technologies in education predict their self-reported proficiency in using different types. They argue that there are two types of attitudes that most influence the usage of DSs (Štemberger & Čotar Konrad, 2021):

Attitudes towards assessment and critical thinking in education significantly predict self-reported proficiency in using communication, digital and online learning tools.

Attitudes towards empowering learners predict self-reported proficiency in using communication tools and digital resources, as well as digital and online learning tools.

Nevertheless, the national culture and practices related to using and implementing DSs play an important role in choosing a DS (Panigrahi et al., 2018), which can be linked to the notion that educators are more engaged in virtual activities when they experience a sense of community in the digital environment (Tsai & Bagozzi, 2014). This has been observed during the COVID-19 pandemic as a social problem in which all educators have been forced to discover new digital possibilities, but are now starting to show greater interest in DLSS and other opportunities to communicate, collaborate, and create a positive learning environment online (Darling-Hammond & Hyler, 2020; Dhawan, 2020; Rubene et al., 2021b).

**Table 1.** DLS Adoption Factors that Positively Impact Their Usage

	<b>Štemberger &amp; Čotar Konrad, 2021</b>	<b>Faustmann, et al., 2019</b>	<b>Panigrahi et al., 2018</b>	<b>Robles, 2016</b>	<b>Kreijns et al., 2013</b>
<b>PERSONAL FACTORS</b>	Attitudes towards assessment and critical thinking Attitudes towards empowering learners	User-friendly, easy to use, intuitive Different learning groups and types are considered Encourages interactions between learners	Perceived usefulness Perceived ease of use Perceived enjoyment Attitude Perception of interaction Self-distraction/playfulness Cognitive absorption Cognitive age Perceived behaviour control Effort expectancy Performance expectancy	Perceived usefulness DLS is appropriate for achieving the objectives Attitude towards using digital technology in education The ease of use Perceived enjoyment of use	Attitude Previous use of DLSs Perceived knowledge and skills to use DLS Self-efficacy
<b>ENVIRONMENTAL FACTORS</b>	Learning materials are always available Quality of the content Offers variety of activities Free of charge Digital safety	Relative advantage Compatibility Triability Observability Nation's generalized trust Eigenvector centrality and closeness National culture Thermal climate and national wealth Social presence Subjective norm Social influence Facilitating conditions System inhibitors Information inhibitors Technology adoption in organizations			Colleagues' use of digital learning materials Subjective norm (influences educators with less experience using ICT)

## **Classification of DLSS**

Although various DLSS are constantly evolving, each solution has its purpose and intended use. As is evident from previous research, educators have different usage patterns for different types of DLSS (García-Martín et al., 2019; Štemberger & Čotar Konrad, 2021). In this study, seven DLSS are distinguished (Rubene et al., 2021a):

1. Electronic teaching resources – non-interactive online teaching materials, such as worksheets, informative presentations, educational videos, and digitized teaching aids, that help to achieve learning objectives and outcomes.
2. Digital teaching resources – interactive online teaching materials, such as online educational games and tests, that also help to achieve learning objectives and outcomes.
3. Learning platforms – digital, interactive online learning and methodological tools that include structured content relevant to the education standards and learning outcomes – theoretical materials complemented with interactive tasks and quizzes providing immediate feedback on learning.
4. Learning management systems – platforms that enable the management and organization of the teaching-learning process in a digital environment and provide the following options: creating virtual classes or groups, exchanging documents, embedding and structuring content, assessing or adding comments (feedback), setting deadlines for tasks and sending specific tasks to a class/group, analysing progress by class or individually, as well as online chat room functionality, etc.
5. Tools for communication and distance teaching and learning – digital tools for remote learning that provide educator-student visual, audial and textual communication, as well as live learning – group work and online chat in addition to video conferencing, video recording, and screen sharing functionalities.
6. Tools for storage/collaboration – tools which allow groups of students and educators to develop a shared documents storage space and collectively work on ideas and projects. These include functionalities such as uploading files, developing shared document maps, editing documents, viewing editing history, leaving comments, etc.
7. Tools for creating learning content – digital tools that can be used to create interactive learning content, such as online tests, quizzes, games and interactive presentations.

## Methodology

This study uses methodological triangulation, meaning that the issue was examined using two research methods (Flick, 2007). First, site traffic data were obtained from the educational platform DigiKlase.lv to determine what kind of DSs educators are most interested in. This nonreactive online data collection shows patterns of user activity that can be enriched using other data-gathering methods, allowing for a more successful interpretation of the findings (Janetzko, 2017). The surveys with educators and prospective educational technology mentors were used to better understand what DSs they have successfully implemented in their practice.

### Non-reactive online data collection

DigiKlase.lv is an educational platform developed by the team of the Scientific Institute of Pedagogy of the University of Latvia. The platform was established to support teachers in Latvia and gather diverse DLS that explain and support the implementation of a technology-enhanced learning process. At the time of this study, the platform had assembled and provided 794 DLSs for educators, together with methodological recommendations and practical instructions to help implement them in the learning process. Each learning solution added to the platform has been thoroughly reviewed by the platform creators, determining: (1) the type of the solution based on previously described categories, (2) the languages and learning subjects in which the solution can be used, (3) the terms of use (registration, usage fee for educators and students, etc.) and other aspects that educators can view before choosing to use the solution. The platform continuously saves data about user activity. Therefore, each user is encouraged to become acquainted with and accept the privacy policy terms and conditions. The data used in this study were collected from 5th July 2021 to 22<sup>nd</sup> December 2021. More than 17,000 unique users from Latvia had visited the platform in this period. In this study, two measurements were analysed: (1) the count of clicks on each DLS description to learn more about it on the DigiKlase platform, and (2) the number of times a DLS was opened, which indicates the frequency at which users accessed the solution (through the webpage link or by opening a document). After the initial click on the solution, it can be opened in several ways: through a direct link to the learning solution, one to the methodological recommendations, or one to the instructions. Each counts as a separate opening of the specific DLS.

The data obtained were coded to depict each DLS, recording the ID, type, language, subject area, pricing, registration, occurrence of the methodological recommendations and instructions for use, as well as number of times a learning solution was clicked on and/or opened. All 794 DLSs were

arranged by the number of times they were clicked or opened. A selection of the most popular DLSs was developed that represented at least 50% of the total DLS (1) clicks, depicted by 104 DLSs, and (2) openings, illustrated by 76 DLSs. The duplications were eliminated, resulting in 111 DLSs (representing 53.5% of user interest) that were further analysed.

An indicator was created that shows the ratio between each DLS openings and clicks. The indicator depicts each DLS engagement statistic – whether users were willing to further open the DLS after clicking on it. The DLSs were arranged based on engagement indicator from lowest to the highest and divided into two comparative groups: (1) solutions that users were very interested in but were not willing to open, and (2) solutions that users wanted to further explore. Each group contained 55 DLSs, leaving the median solution out of further analysis. Two groups were further analysed to characterize what types of DLSs and resources gain the most user interest.

### **Survey with prospective technology mentors**

A survey was developed to analyse what types of DLS teachers have successfully used in their practice. This data was compared between different subject areas and age groups to determine changes in DSL usage in diverse contexts. Survey was offered to educators who had chosen to take part in a two-year professional development course to become technology mentors (Sarva et al., 2022), as well as Erasmus+ project INTEGRA educators from Latvia who have significant experience in the usage of educational robotics and digital technology for teaching and learning. Educators were informed that the data gathered from their self-evaluation would be anonymized and used in research and had the option of declining to take part in the survey in case they disagreed with sharing their data. The summarized results were accessible to the professional development course material authors and educator trainers to customize the contents for participant needs. The survey questions analysed in this study include work experience, student age group, educator's subject area and the DSs successfully used by educators.

The 1060 responses were collected and compiled in Google Spreadsheets. Duplicate or otherwise invalid answers were removed. The remaining 798 responses were anonymized and further analysed. Google Spreadsheets and SPSS (Statistical Package for the Social Sciences) were used for further data sorting, analysis and visualization.

## Results

### DLs that educators are most interested in

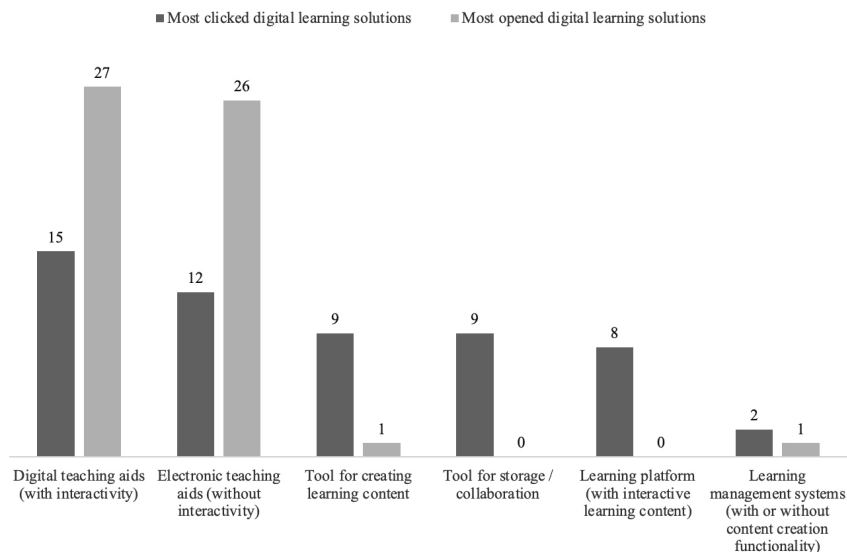
In the data analysis, the statistics of the 111 most popular DLs were used, representing 53% of all DigiKlase.lv DLs clicks and openings. Digital teaching resources were the most common type of DL (see Table 2). However, there were no communication and distance teaching-learning tools within the most popular DigiKlase.lv DLs. Another aspect to consider is the engagement for each type of DL, where electronic teaching resources have the highest opening rate, followed by digital teaching resources and learning management systems.

**Table 2.** Characteristics of DLs Included in Analysis

Type of DLs	Number of DLs	Engagement indicator (DLs opening and click ratio)
Electronic teaching resource (without interactivity)	38	1.02
Digital teaching resource (with interactivity)	43	0.85
Learning platform (with interactive learning content)	8	0.54
Learning management system (with or without content creation functionality)	3	0.84
Tool for communication and distance teaching-learning	0	--
Tool for storage/collaboration	9	0.34
Tool for creating learning content	10	0.35

Dividing the most popular DLs into (1) ones that are gaining clicks and (2) solutions that are likely to be further explored after a click shows that DigiKlase.lv users are more engaged with electronic and digital teaching resources, which they open and further explore more frequently than any other type of DL (Fig. 1). These types of DLs users often open a resource more than once, meaning they watch the video instruction about the resource, in addition to becoming acquainted with methodological recommendations, etc.



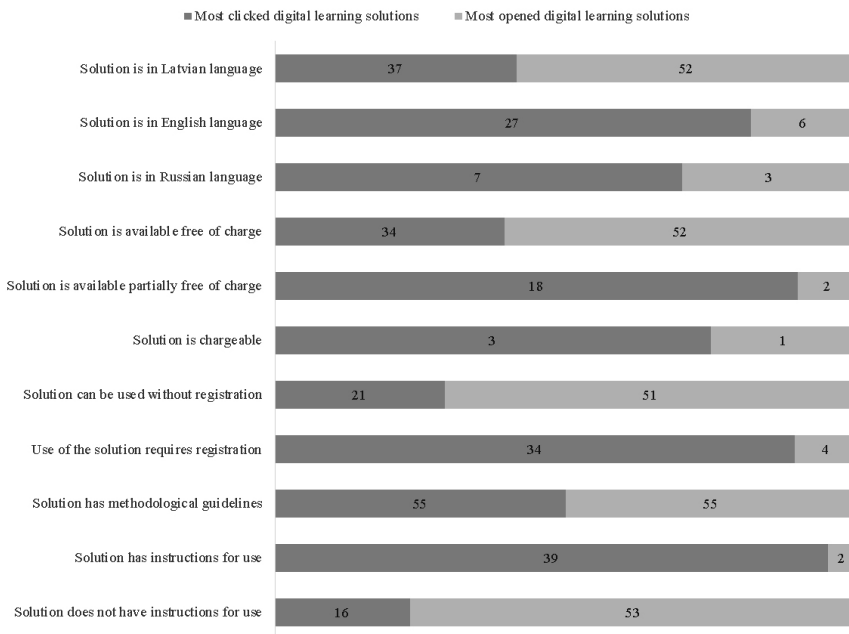


**Figure 1.** User Engagement with Different Categories of DLSs

Nevertheless, users show significant interest in digital tools and learning platforms, exploring available information on the DigiKlase.lv platform about their use and functionality, but not opening the tools to examine them further themselves. There are two exceptions where tools are frequently opened after a click: one is a tool for creating learning content and the other is a learning management system (Fig. 1). The tool for creating learning content that was commonly opened was Uzdevumi.lv, which is the largest and most popular assignment development tool in Latvia (Daniela et al., 2018). The most opened learning management system was Skolo.lv, a system recently developed by the national-level project Skola2030 (Skola2030, 2022).

The in-depth analysis of the most popular DLSs reveal the qualities that users are looking for in a DLS (Fig. 2). First, users are looking for and further opening DLSs in Latvian language. DLSs in other frequently used languages in Latvia such as English and Russian are attracting user clicks, but not being further explored. Second, users are interested in DLSs that are free of charge. They are still interested in solutions where part of the functionality is available at no cost, but they usually do not explore them further on the DigiKlase platform. Third, registration to use a DLS adversely affects the use of a solution both in the user's first interest in the solution as well as looking into it more. Finally, the support information about a DLS, such as instructions and methodological guidelines, play an important role when the educator is choosing a solution. Methodological guidelines are present in all 111 most popular DLSs and therefore can be considered an important

factor for users choosing to further explore a specific solution. Instructions for use, on the contrary, do not promote the further exploration of the solution, and even have a negative impact on it.



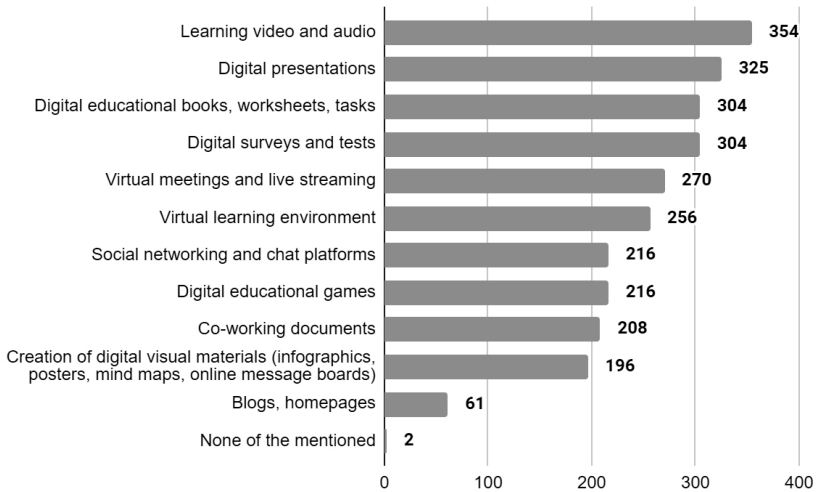
**Figure 2.** DLS Features and User Engagement

### DSs that educators use in their pedagogical practice

To determine the use of DSs in pedagogical practice, a survey was carried out amongst educators taking part in a course to become educational technology mentors and educators involved in the Erasmus+ project INTEGRA and 798 responses were analysed. Amongst these, 302 educators were primarily working in preschool, 189 in primary, 161 in secondary and 146 in high school. Of these educators, 66.9% had 10 or more years of experience working in school, and only 4.1% had two or less. Educators from all subject areas took part in the survey, with many of them representing more than one – 57% of the participants associated themselves with the technology area, 37% with mathematics, 37% with languages, 36% with nature sciences, 29% with social sciences and civics, 25% with cultural awareness and self-expression and the least, 16%, with health and physical activities.

The data indicate that learning videos and audio, digital presentations and digital educational books, worksheets and tasks, as well as digital

surveys and tests, are the most successful DSs used for educational purposes (Fig. 3). Fewer educators indicate that they have had success with using blogs and homepages, as well as the creation of digital visual materials, in addition to employing co-working documents for educational purposes.



**Figure 3.** Types of DSs Successfully Used by Educators (Self-Evaluation)

A Kolmogorov–Smirnov test was performed to determine the normality of the data distribution. It was determined that the data are not parametric ( $p < 0.01$ ). Non-parametric statistical methods were therefore used for further data analysis.

A Spearman correlation analysis was run to determine possible correlation between measured factors. No strong correlations were found between the successful use of DSs and educator work experience, student age group or subject area.

Moderate ( $<0.7$ ) negative correlation ( $p < 0.01$ ) was noted for the preschool age group, indicating that almost all groups of DSs were less often used successfully for learning within this age group. Moderate positive correlations ( $>0.3$ ) that were statistically significant ( $p < 0.01$ ) were observed for the use of online learning environments and digital surveys and tests for elementary school students, and for creating digital visual materials, in addition to using digital surveys, tests and online learning environments, as well as using digital co-working documents for secondary and high school students. Moderate ( $>0.3$ ) and statistically significant ( $p < 0.01$ ) negative correlations were found for using digital surveys and tests in nature science, health and physical activities, languages, social and civics studies and the area of cultural awareness and self-expression. Online

learning environments were less successfully employed (correlation  $< -0.3$  and  $p < 0.01$ ) in areas relating to health and physical activities, as well as cultural awareness and self-expression. Digital co-working documents were less successfully utilized in the social and civic study area (correlation  $< -0.3$ ,  $p < 0.01$ ).

## Discussion and conclusions

During the past few years, due to the COVID-19 pandemic, the need for and interest in DLSs have significantly increased. Educators have been forced to discover new ways to interact and organize teaching and learning, consequently developing new skills and exploring the possibilities. In this study, we aimed to answer two questions: (1) what kind of DSs are educators most interested in, and (2) which DSs have educators successfully implemented in their practice?

The site traffic data from the platform DigiKlase.lv and data from surveys with prospective technology mentors show that educators were most interested in simple electronic or digital teaching resources that closely resembled ordinary workbooks and textbooks. The popularity of these solutions can be explained by educators' previous use of these types of materials (Kreijns et al., 2013), as well as the subjective norm of what kind of solutions can and should be used in the educational setting (Kreijns et al., 2013; Panigrahi et al., 2018; Robles, 2016).

In this study, factors such as the use of national (Latvian) language, being free of charge, and having methodological guidelines have demonstrated the increased interest of educators in DLSs and can also be recognized as facilitating conditions (Panigrahi et al., 2018) for educators choosing DLSs.

Although the educators showed interest in different types of digital tools that allow active engagement both from educator and student, they were hesitant to further explore them. These DSs are more complex and require learning to use them; therefore, the perceived ease of use and enjoyment can be lower and the effort expectancy to use higher, which repels educators from initially starting to employ them (Panigrahi et al., 2018; Van Acker et al., 2013). The availability of instructions for using a DLS does not convince educators to explore the solution further. On the contrary, the data show that educators avoided DSs with such instructions that might emphasize the complexity of the solution. Furthermore, many digital tools are not free of charge, which in this study and Faustmann et al.'s (2019) analysis represents a significant obstacle for an educator to start a new DS implementation in the teaching-learning process.

DigiKlase.lv users had a minor interest in tools for communication and distance teaching-learning and learning management systems. This can be

explained by technology adoption in organizations (Panigrahi et al., 2018), as, during the pandemic, most schools had agreed-upon tools that they were using for communication with students, parents, and colleagues, meaning educators did not have the need to search for these DSs themselves, but rather adopted the ones already used in their organization.

It can be concluded that educators felt safer using and were more interested in DSs that replicate existing learning experiences than those which are characteristic of the virtual learning environment. Therefore, they preferred replicating existing learning experiences rather than creating new kinds of experiences customized for virtual mediums. In the virtual medium this means stripping much of the possible interactivity offered by DSs, which makes learning more frontal and less engaging. This is concerning, considering how important the engagement of students is, perhaps especially in virtual learning (Abrami et al., 2011; Bernard et al., 2009; Martin & Bolliger, 2018). Educator preferences for less sophisticated DSs have been observed in Latvian education system before (Daniela et al., 2018), and a lack of engaging DLSS, especially in the Latvian language, has also been established (Daniela et al., 2021). To what extent the observed educator preferences were connected with the lack of qualitative DLSS in certain digital formats such as games, as well as the accessibility of DSs and skills for using them properly, in addition to enthusiasm in using more engaging approaches for virtual learning and other influencing factors remains undetermined.

DSs were less used in the preschool age group. This is perhaps not surprising, considering the specifics of the age group, including the fact that many DSs are not well customized for young students for extended periods of time (Gottschalk, 2019; Rubene et al., 2021a). However, even at a young age students should be offered opportunities to learn competence in using DSs, perhaps particularly because this age group is potentially most negatively influenced by the misuse of DSs. DSs are also less used in other subject areas, apart from technologies. This could be connected with the fact that educators teaching subjects connected with technologies are more competent in using DSs, but could also indicate that educators are exposed to social influence and their colleagues' use of DSs and selectively choose DSs based on subjective norms of the subject they teach (Kreijns et al., 2013; Panigrahi et al., 2018).

In terms of further research, it will be important to analyse reasons for educators selecting particular DS for their practice, to understand what support should be provided for educators to better implement DSs in learning and ultimately provide qualitative technology-enhanced learning for every student.

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